

CLAIMS

1. A magnetic thin film for high frequency, characterized by comprising:

a first layer comprising a T-L composition (wherein T is Fe or FeCo, and L is at least one element selected from the group consisting of C, B and N);

a second layer comprising a Co based amorphous alloy and disposed on either of the surfaces of said first layer; and

a third layer disposed on either of said first layer side or said second layer side, and having an electric resistance higher than said first layer and said second layer;

wherein a plurality of said first layers, a plurality of said second layers and a plurality of said third layers are laminated to form a multilayer film structure.

2. The magnetic thin film for high frequency according to claim 1, characterized in that every time laminating of said first layer and said second layer is repeated a predetermined number of times, said third layer is disposed.

3. The magnetic thin film for high frequency according to claim 2, characterized in that said predetermined number of times is 1 to 5.

4. The magnetic thin film for high frequency according to claim 1, characterized in that T constituting said T-L composition is FeCo.

5. The magnetic thin film for high frequency according to claim 4, characterized in that the concentration of Co in said T-L composition is 10 to 50 at%.

6. The magnetic thin film for high frequency according to claim 1, characterized in that L constituting said T-L composition is C and/or B.

7. The magnetic thin film for high frequency according to claim 1, characterized in that:

    said Co based amorphous alloy comprises Co as a main component and an element M (wherein M is at least one element selected from the group consisting of B, C, Si, Ti, V, Cr, Mn, Fe, Ni, Y, Zr, Nb, Mo, Hf, Ta and W); and

    the concentration of said element M in said Co based amorphous alloy is 10 to 30 at%.

8. The magnetic thin film for high frequency according to claim 1, characterized in that said third layers are each at least one of a granular structure film, an oxide film, a nitride film and a fluoride film.

9. The magnetic thin film for high frequency according to claim 1, characterized in that the saturation magnetization thereof is 14 kG (1.4 T) or more and the resistivity thereof is  $200 \mu\Omega \text{ cm}$  or more under the condition that said first layers, said second layers and said third layers are laminated.

10. The magnetic thin film for high frequency according to claim 1, characterized in that the real part ( $\mu'$ ) of the complex permeability thereof at 1 GHz is 300 or more, and the quality factor  $Q$  ( $Q = \mu'/\mu''$ ) thereof is 10 or more.

11. The magnetic thin film for high frequency according to claim 1, characterized in that when  $T_1$  denotes the thickness of each of said first layers and  $T_2$  denotes the thickness of each of said second layers,  $T_1$  falls within the range of 0.5 to 3.0 nm and  $T_1/T_2$  falls within the range of 0.8 to 3.0.

12. The magnetic thin film for high frequency according to claim 1, characterized in that when  $T_1$  denotes the thickness of each of said first layers and  $T_2$  denotes the thickness of each of said second layers,  $T_1$  falls within the range of 3 to 70 nm and  $T_1/T_2$  falls within the range of 0.15 to 3.50.

13. A composite magnetic thin film, comprising:  
a first layer which is mainly composed of Fe or FeCo,  
has by itself a saturation magnetization of 16 kG (1.6 T) or

more, and is constituted as a columnar structure with an aspect ratio of 1.4 or less or as an amorphous structure; and a second layer which is mainly composed of Co, and has the properties by itself such that a permeability of 1000 or more (measurement frequency: 10 MHz), a saturation magnetization of 10 kG (1.0 T) or more, and a resistivity of 100  $\mu\Omega$  cm or more;

the composite magnetic thin film being a laminate in which said first layers and said second layers are laminated; characterized in that

third layers each having an electric resistance higher than said second layers are disposed on the surface and/or in the interior of said laminate.

14. The composite magnetic thin film according to claim 13, characterized in that said third layers are each a magnetic substance.

15. The composite magnetic thin film according to claim 13, characterized in that the total thickness of said composite magnetic thin film is 200 to 3000 nm.

16. The composite magnetic thin film according to claim 13, characterized in that the proportion of said third layers in relation to said composite magnetic thin film is 40 vol% or less.

17. The composite magnetic thin film according to claim 16, characterized in that the proportion in relation to said composite magnetic thin film is 3 to 20 vol%.

18. The composite magnetic thin film according to claim 13, characterized in that said first layers are each composed of an amorphous structure.

19. A magnetic device comprising a magnetic thin film for high frequency, characterized by comprising:

    a first layer comprising a T-L composition (wherein T is Fe or FeCo, and L is at least one element selected from the group consisting of C, B and N);

    a second layer comprising a Co based amorphous alloy and disposed on either of the surfaces of said first layer; and

    a third layer disposed on either of said first layer side or said second layer side, and having an electric resistance higher than said first layer and said second layer;

    wherein a plurality of said first layers, a plurality of said second layers and a plurality of said third layers are laminated to form a multilayer film structure.

20. The magnetic device according to claim 19, characterized in that said third layers are each formed of a granular structure film.

21. The magnetic device according to claim 19, characterized in that the concentration of said element L contained in said T-L composition is 2 to 20 at%.
22. The magnetic device according to claim 19, characterized in that said magnetic device is an inductor or a transformer.